NOTES BY THE EDITOR.

OBSERVATIONS AT HONOLULU, HAWAIIAN ISLANDS.

As the weather on our Pacific coast depends largely upon the condition of the atmosphere to the westward, it is considered important to publish in full, and as soon as practicable, the data furnished by observers in Alaska, the Hawaiian Islands, and intermediate regions.

Meteorological observations at Honolulu, Republic of Hawaii, by Curtis J. Lyons, Meteorologist to the Government Survey.

Pressure is corrected for temperature and reduced to sea level, but the gravity correction, −0.06, is still to be applied.

The absolute humidity is expressed in grains of water, per cubic foot, and is the average of four observations daily.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 10.

The rainfall for twenty-four hours is given as measured at 6 a. m. on the respective dates.

February, 1895.	Pressure at sea level.			Temperature.					Humidity.			Wind.		Cloudiness.	Rain measured at 6 a. m.
									Relative.						
	9 a. m.	3 p. m.	9 p. m.	6 a. m.	2 p. m.	9 p. m.	Maximum.	Minimum.	9 a. m.	9 p. m.	Absolute.	Direction.	Force.		
	Ins.	Ins.	Ins.	°	°	°	°	°	%	%					Ins.
1..	29.90	29.81	29.88	66	75	72	77	65	90	75	6.8	sw.	4	7	0.29
2..	29.82	29.74	29.78	71	76	71	77	70	75	90	6.9	ssw.	5	7	.04
3..	29.83	29.80	29.87	71	72	71	76	64	84	77	6.9	sw-w.	3-0	10	.95
4..	29.96	29.91	30.02	68	76	69	77	68	77	79	6.4	sw.	2	5-2	.27
5..	30.03	29.96	30.08	61	75	66	77	61	84	90	6.3	s.	0-2	3-0	.06
6..	30.07	29.96	30.08	68	76	68	78	68	77	90	6.6	s.	1	3	.00
7..	30.05	29.96	30.04	64	75	68	78	64	74	84	6.6	s.	1	5	.00
8..	30.04	29.98	30.06	68	77	66	79	68	77	87	6.8	n-s.	1-0	3-0	.00
9..	30.07	29.97	......	68	78	....	80	68	75	....	.....	n-s.	1	2-4	.00
10..	30.05	29.98	30.04	67	78	72	79	67	77	86	7.1	s.	2	3	.00
11..	30.06	30.01	30.06	70	77	72	79	70	85	85	7.5	s.	1	5	.00
12..	30.02	29.94	30.00	71	77	74	79	68	77	77	7.3	s-sw.	3	2-7	.08
13..	30.11	30.06	30.13	64	70	68	74	63	69	54	4.8	n.	2-5	8-1	.09
14..	30.19	30.12	30.19	67	73	69	74	61	45	55	4.2	nne.	5	1	.00
15..	30.21	30.14	30.22	69	74	70	75	68	54	62	5.1	ne.	4	5	.00
16..	30.20	30.12	30.15	69	74	70	76	68	65	70	5.5	e.	3	5	.00
17..	30.18	30,07	30.14	67	74	70	76	66	70	72	5.7	e.	1	7	.00
18..	30.16	30.08	30.14	65	74	71	77	64	62	62	5.5	ne.	3	5	.00
19..	30.13	30.04	30.10	66	75	71	77	65	62	65	5.6	ne.	3	8	.00
20..	30.12	30.08	30.12	68	69	68	73	66	70	80	6.3	n.	3	10	.08
21..	30.15	30.06	30.10	68	71	68	72	67	66	76	5.5	nne.	4	10	.59
22..	30.12	30.06	30.12	68	73	70	74	67	74	68	5.8	ne.	4	4	.02
23..	30.10	30.02	30.07	68	74	64	77	68	61	79	5.5	ne.	3	2	.00
24..	30.10	30.02	30.07	61	75	67	78	59	62	79	6.0	ne-s.	0-1	1	.00
25..	30.07	30.03	30.14	71	71	65	76	67	80	63	5.5	w-n.	3-1	10-0	.00
26..	30.21	30.13	30.21	65	71	66	72	62	49	52	3.9	n.	6-7	2	.21
27..	30.22	30.16	30.22	65	72	74	74	62	59	55	4.3	nne.	3	3	.00
28..	30.26	30.18	30.24	66	72	68	74	64	65	65	5.0	ne.	4-5	8	.00
.	30.067	30.013	30.080	66.6	74.1	69.1	76.3	65.2	70.2	73.6	5.9	....	......	......	2.68

Mean temperature: 6 + 9 + 2 + 3 is 69.9; the normal is 70.4; extreme temperatures, 80° and 59°.

Thunderstorms: 2d, in the evening from SW.

High winds: 14th and 16th, N.

Last half of month, atmosphere was unusually dry.

CORRESPONDENCES IN EUROPEAN AND AMERICAN WEATHER.

Mr. Joseph Brücker writes in the Staats-Zeitung, Chicago, February 8, as follows:

The late Professor Dove, of Berlin, one of the founders of meteorology, has propounded the law that the weather in Europe offsets that in America; that is to say, it is warm there when it is cold here; that the winter is severe there when it is very mild here; and, finally, that a cold, wet summer in Germany is accompanied by a hot, dry summer in the United States. This law of Dove's does not, however, always prevail.

Last year when America, simultaneously with Europe, suffered from the oppressive heat we expressed, in an article in the Staats-Zeitung, our doubts as to the correctness of Dove's rule and sought, by a hypothesis advanced by us several years ago, to explain the conditions of the weather. We recapitulate this theory briefly as follows:

Our country east of the Rocky Mountains belongs to the great North Atlantic atmospheric whirl which receives its impetus, its warmth, and moisture from the tropics. The Gulf Stream is the maritime continuation, the oceanic twin brother of this atmospheric whirl, and both have the closest connection with each other. While, however, a definite boundary for the Gulf Stream is established by the coasts of the continents, i. e., our Atlantic shore, the west coasts of Europe, north Africa, and the north coast of South America, on the other hand, the atmospheric current which is continually flowing over the West Indian Islands toward the high plateaus of Mexico and Texas and the Rocky Mountains then turns and moves northeast toward Europe, then turns south, becoming again the trade wind, and thus completes its course; it resembles an elastic band that, although in the main it remains in the same position, yet in detail takes upon itself various forms and positions. As the energy of this current originates in the tropics, the weather conditions of Europe depend upon the energy, moisture, and temperature which the currents of air bring with them from the American and North Atlantic latitudes. If a part of this energy is given away as heavy rains in America, or is weakened by severe cold on this side, then the atmospheric whirl will not penetrate so far into the European region, but will sooner turn southward and make room for the compensating east wind, which will bring severe cold to Europe in the same way that the northwest wind does in America.

Thus it can well happen that continuous severe rainfall on this side of the Atlantic Ocean will occasion a dry summer in Europe and seem to confirm Dove's rule, whereas our hypothesis covers all cases and agrees with Dove's only in certain cases, and therefore we are justified in claiming the greater probability in favor of our own.

Although the general circulation of the atmosphere is by no means so systematic as above described, yet the conclusion given in the last sentence will sometimes hold true, namely, that an excess of rain on one side accompanies a drought on the other side of the ocean, but it would not do to expect that these contrasted climates will necessarily occur over Europe and the United States respectively. The balance may occur over other countries to the north or south, or it may occur far in the interior of the two continents as well as on the coast. The motions of the atmosphere above the 3,000-foot level are but slightly affected by the presence of continents and oceans, but only by high plateaus and mountain ranges. The droughts and rains that we experience are due far more to the changes going on in the general upper circulation than to the local conditions of the lowest strata. It is only in very special localities that the latter are more important. Neither our knowledge of the laws governing the motions of the atmosphere, nor our knowledge of the climatic statistics of the last century, justifies the expectation that there can be any simple relation between the rainfalls or the temperatures of definite regions in Europe and America. Nevertheless, there are, and ought to be, complex relations still to be discovered, by means of which long-range forecasts may become possible.

OPTICAL PHENOMENON AT WASHINGTON, D. C.

On Wednesday, February 13, 1895, there prevailed clear sky, slight haze, westerly winds, much light snow driven in the air, and whitish haze spots in the sky; a horizontal circle of about 15° radius, concentric with the zenith, extended about 45° in azimuth either side of the sun's azimuth; it showed a brilliant spectrum, whose red side was below, or nearest, the sun. At about 9.15 it began fading away. At this time the angle between the center of the arc and the center of the sun was about 55° and the altitude of the sun was about 20°.

Snow is composed of ice crystals, of which the simplest forms are regular hexagonal plates and hexagonal prisms made up of such plates, which prisms may have either broad, flat, or smaller truncated ends. These regular hexagons are considered to be made up of primitive rhombohedrons, viz, parallelopipedons, whose faces are regular lozenges. The six faces are all inclined to the axis at the same angle, viz, 54° 44′, as measured by Clarke and adopted by Bravais. Snow crystals are sometimes 6-rayed stars where angles of 30° can occur. In general, the rays of light passing through prisms of ice encounter the faces of the prism at angles of 120° or 119° 28′, or 60° or 59° 44′, or 30°. Air that is apparently very clear may contain many ice crystals slowly descending, and therefore in every imaginable position with reference to the observer and the sun, and enough will at any moment be in any given position to produce decided optical effects. If the air is still and the prisms are descending quietly many will have their axes vertical and the plane plates at their ends horizontal, while others will be rapidly rotating round their longer axes and will have the end plates vertical. The reflections from these plates will produce horizontal and vertical bands of bright light intersecting at the sun and at a point opposite to the sun in azimuth. The arcs of colored light, or rainbows, such as above described at Washington, are produced by rays that enter and leave the prisms through faces or facets that are inclined to each other by an angle of 54° 44′ or 109° 28′, or some other multiple of the angles above enumerated. The exact measurement of the location and dimensions of all the phenomena attending a solar halo would enable one to determine the shapes and positions of the descending prisms of ice.

DUSTSTORM.

Mr. I. M. Stackhouse, Stattler, Crawford Co., Ark., forwarded a sample of dust that fell in that place on the night of February 7, 1895. A north wind, which began about 3 p. m. of the 7th, had by midnight reached 60 miles per hour. The next morning this dust was found, discoloring the snow that had fallen two weeks before. The amount sent was obtained from about one quart of snow. This dust is similar to that of the duststorm reported in the REVIEW for January. (See also the paragraph *Missouri* in the chapter on State Weather Services in this number of the REVIEW.)

DESCENDING WARM WINDS.

Attention has frequently been called in previous REVIEWS to the fact that whenever a low area is central on the eastern slope of the Rocky Mountains the inflowing westerly winds show the warming due to their rapid descent from the higher land to the west. An excellent illustration of this is shown on the maps of the 19th and 20th. On the morning of the latter date low No. XVI was central in Manitoba and an area of 20° or 30° rise in 24 hours covered the region between Colorado, Minnesota, and Assinniboia, the temperatures having risen from 10° or 20° F. to 30° or even 50°, with strong northwesterly winds. At this time a ridge of high pressure extended from Texas to Oregon, and so long as light winds prevailed on the eastern slope low temperatures continued, but when, on the 20th, high winds sprung up, owing to the presence of the low, the temperature at once rose, without any material change in the direction of the wind. There can be no reason to doubt but what this is a case of dynamic warming due to compression.

THE NOISE MADE BY A METEOR.

The attention of the Editor having been specially called by a correspondent to certain mysterious noises heard at stations in Florida on February 7 or 8, at the time of the remarkable cold weather, it seemed best to investigate this subject, at least far enough to justify one in deciding for or against the various suggestions as to its being an earthquake, or an electrical phenomenon, or a discharge of artillery, or the noise of distant blasting. In reply to circulars sent out by Mr. E. R. Demain, Director of the State Weather Service, about twenty-five reports were received. Most of the observers state that no noises were heard, but eleven stations sent in reports sufficiently definite to suggest the correct explanation of the explosions heard between 11 a. m. and noon of the 7th. These reports are given in abstract, as follows:

Kissimmee.—About 5 a. m. of February 8 very loud sounds, resembling reports of artillery, were heard in the air. The sound is said to have been heard at a distance of 8 miles. The cause is not known. It is supposed to have originated in the northern part of this town, about 15 feet north of the Florida Midland Railroad, where the ground was slightly torn up.

Orlando.—The detonations were heard in Orlando on the 7th (Thursday), not on the 8th. On Thursday, just before noon, many residents living east and southeast of Orlando saw a bright meteor pass over toward the north, and its disappearance was followed by a noise as of a loud explosion. Later reports state that a double explosion occurred about 11 a. m., and several report that it shook their houses as would an earthquake; one, who was in bed at the time, felt the house shake and heard the loud report. These persons state that the noise appeared to come from some point southeast of them.

Winter Park.—Some one at the college states that a meteor passed over the college about 11 a. m. on the 7th, and is said to have fallen at Forest City, and that the noise was heard in Orlando.

Oviedo.—"12 miles southeast of Orlando." (So stated by letter, but the chart locates it 12 miles northeast of Orlando.) The double detonation, or twin reports, were heard at 11 a. m. of the 7th, following one another in quick succession and still southeast of them.

Tarpon Springs.—Several families noted detonations, strong enough to jar houses, between 6 and 10 p. m. of the 8th, supposed to be thunder, although the sky was clear and there was no lightning. The first noises came from the east, later ones from the zenith, and finally from the west.

Orange City.—No noises were heard, but at Kissimmee a meteor burst and fell. No pieces were obtained.

Green Cove Springs.—Heard some peculiar sounds during the storm (7th or 8th?); the first were the louder and like thunder and from the southwest; the last reminded one of the booming of distant sunset guns at sea, and apparently came from the northeast.

Plant City.—No noises on the 8th, but on the 7th, about noon, heard what I supposed was distant, heavy thunder in the southeast, that reminded me of heavy siege guns a long way off. I did not note it as thunder, as I supposed that it was a blasting at the phosphate mines, as it was in that direction and I was told so by a citizen.

Amelia.—Some persons remarked heavy sounds, like distant guns or cannon, at the time of the cold wave, but they do not remember the date. Some thought it was like thunder, only shorter, and there were no clouds. I remember hearing a good many reports one day, something like shot guns, and yet different from that—rather sharper and heavier. I could not tell where they came from or whether far or near.

Clermont.—About twelve different persons heard such a noise on the 7th (but not on the 8th), between 11 a. m. and noon, standard time. Some thought the noise came from the east, others from the northeast, and yet others from the west; none seemed to think that it came from overhead; they all thought of the shooting of a cannon when they heard it.

In explanation of these reports it may be stated that those from Kissimmee relate to a sound heard at 5 a. m. of the 8th, whose origin is unknown.

The reports from Orlando, Winter Park, Oviedo, and Forest City, and those from Clermont and Orange City almost certainly relate to a meteor that passed northward over Winter Park between 11 a.m. and noon of the 7th. The observations at Plant City in all probability refer to the same meteor, and if the report from Tarpon Springs has been ascribed to the wrong hours and date, then it is quite possible that the sound of the same meteor was heard at that place. If the report from Kissimmee were not so definite as to hour and day and locality it would be plausible that this referred also to the same meteor.

It is perfectly possible that three meteors occurred: (1) at 11.30 a. m. of the 7th, (2) at 5.30 a. m. of the 8th, and (3) between 6 and 10 p. m. of the 8th.

The noises that are sometimes heard in connection with meteors, and which are generally spoken of as explosions, may properly be classed as meteorological phenomena, and if we had more accurate observations of the path of the meteor, the character of the noises, and the intensity of the light and heat, we could undoubtedly deduce therefrom some results of interest to meteorology, just as the astronomer deduces from the direction and velocity of the motions of meteors results of great interest to his science.

Meteors shoot into the earth's atmosphere with an immense relative velocity, sometimes as great as 40 miles per second, and in their onward rush strike the thin upper air with very much the same effect as when one brings his hand down with great force upon a surface of water. The air is compressed and carried along with the meteor and also driven outward with great force; a great heat is evolved and the surface of the meteor is rapidly burned away. The compression and burning take place so quickly that the heat does not penetrate deeply into the body of the meteor, and when one is picked up, after falling to the ground, it is often found to have a very cold interior.

On account of its irregular shape and the consequent irregularities of the pressure in front the meteor usually acquires a rotation about its center. This rotation introduces many irregularities in its strokes against the atmosphere. The spitting, snapping blows due to the cracking off and gradual breaking up of the meteor combine with the general noise of the irregular strokes against the air, but the latter are the principal sources of sound. After the meteor has disappeared, which usually happens in a few seconds, there is left, as it were, a long hole or track in the air, into which the atmosphere is rushing back to fill it up. From this track and around it as an axis there spreads a rapidly widening wave of compression or noise. The phenomenon of the inward rush of the air and the filling up of the trail of the meteor is precisely similar to that which follows the snapping of a whip, the flash of lightning, or the passage of a rifle ball, but the principal wave of compression is due to the strokes of the meteor on the atmosphere and is only feebly imitated by the air wave in front of a cannon ball, since the meteor moves from twenty to a hundred times faster than the latter.

We must liken the wave of impact, or compression, to the little wave that starts at the prow of a steamboat and spreads to the right or left, forming what Scott Russell calls the great primary wave of propulsion on the water. The angle at which this wave spreads out depends upon the speed of the boat and the speed at which gravitation waves advance at the surface of the water, and it is therefore smaller in proportion as the boat goes faster. In the case of a meteor the angle depends on the ratio between the velocity of sound in the air and the velocity of the meteor, which ratio may be about as 1 to 100. Therefore, at the moment when the meteor disappears (either by burning up or by breaking to pieces, or by striking and stopping at the earth's surface, or by passing entirely through the upper atmosphere and out again into the free space in a nearly horizontal path) the wave of sound, which is a wave of violent compression of the air with numerous irregularities superposed upon it at every point along its extent, has the form of a slender cone whose apex is at the head of the meteor, and whose base is far behind where the meteor first struck the atmosphere. The angle subtended by the sides of the cone may be about one-half of a degree of arc. An observer at the earth's surface will not hear any noise from the meteor until the surface of this cone reaches his ear by enlarging, as it does, at the rate of about 1,100 feet per second, and the first sound that reaches him comes from the nearest point of the path. The sound is so intense that it may be heard as distant thunder 100 miles away, but of course this depends upon the condition of the atmosphere and the quiet surroundings of the observer. If, as is usual in the daytime, the lower atmosphere is a mixture of rising and falling currents of warm and cold air, then the sound wave is broken up and rapidly enfeebled. A similar enfeebling happens to a beam of light when it passes through great distances of mixed warm and cold air.

In the present case, on February 7, it is within bounds to assume that a meteor entered the atmosphere 20 or 30 miles south or southeast of Orlando, and at a height of 100 miles; it pursued its rapid flight, inclining downward toward the earth's surface at an angle of 20° to 40°, passed over Orlando and Oviedo northward, and burned up and disappeared by the time that it got within 5 miles of the earth's surface, some distance to the north of Winter Park or Forest City. The nearest approach to the observers at these places would then be from 5 to 15 miles; the wave of sound would require from twenty-five to seventy-five seconds to reach their ears, and if the observer at Clermont or at Plant City, 50 miles southwestward, heard the same sounds, as is perfectly possible, he would have done so a minute or two later. When such sounds traverse the air nearly horizontally they are liable to be refracted and reflected just like beams of light; they may pass over one group of stations and descend upon a distant group. If such a case is well observed, it gives us the means of ascertaining the relative density, or the temperature, pressure, and moisture at different heights in the atmosphere, and the same may be said of the noise attending a flash of lightning. A wind that is stronger in the upper layers than near the ground, and this is the normal condition, will deflect the sound wave downward and thus diminish the distance to which the noise can be heard on the leeward side, but increase the distance of audibility on the windward side. In some special cases the layers of dense and rare atmosphere may be so arranged that a sound wave may be totally refracted, or reflected, and may thus bound over a large region, being inaudible to observers at the ground but audible to those a few hundred feet above. It is thus that distant thunder and perhaps even fog signals are heard in one place and not in others near by. It does not seem likely that the noise heard at Kissimmee had any mysterious electrical, geological, or volcanic origin.

METEOROLOGICAL TABLES.

[*Prepared by the Division of Records and Meteorological Data.*]

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only the 8 p. m. observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation.

Table II gives, for about 2,400 stations occupied by voluntary observers, the extreme maximum and minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (....).

Table III gives, for about 30 Canadian stations, the mean pressure, mean temperature, total precipitation, prevailing wind, and the respective departures from normal values. Reports from Newfoundland and Bermuda are included in this table for convenience of tabulation.

Table IV gives, for 82 stations, the mean hourly temperatures deduced from thermographs of the well-known pattern manufactured by Richard Bros., Paris, described and figured in the Report of the Chief of the Weather Bureau, 1891–'92, p. 29.

Table V gives, for 67 stations, the mean hourly pressures as automatically registered by barographs of the pattern manufactured by Richard Bros., Paris, except for Washington, D. C., where Foreman's barograph is in use. Both instruments